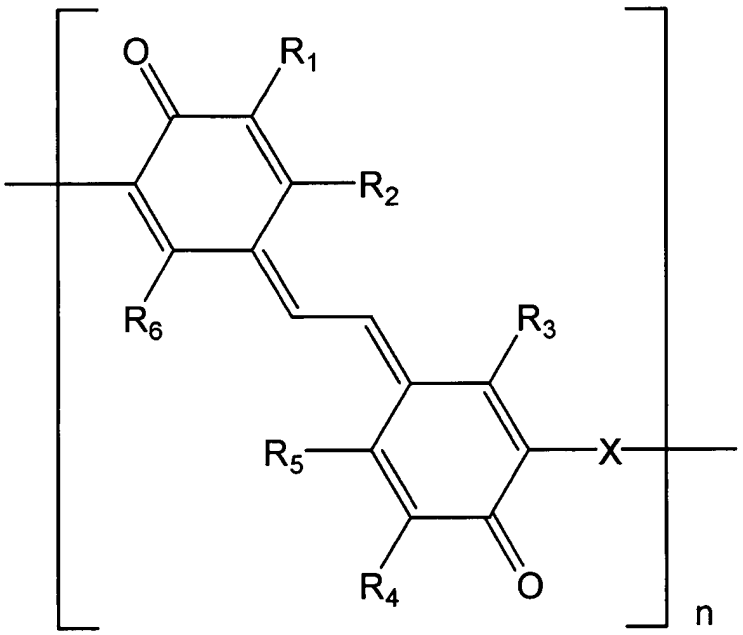
CLAIMS

What is claimed is:

1. A polymer represented by the following chemical formula 1:

Chemical Formula 1



wherein R_1, R_2, R_3, R_4, R_5, and R_6 each independently is selected from the group consisting of a hydrogen atom, a halogen atom, a hydroxy group, a carboxyl group, a cyano group, an amino group, a nitro group, an optionally substituted alkyl group with 1 to 20 carbon atoms, an optionally substituted aryl group with 6 to 30 carbon atoms, an optionally substituted arylalkyl group with 7 to 30 carbon atoms, and an optionally substituted alkoxy group with 1 to 20 carbon atoms; -X- represents a single bond, -S-, -O-, -NH-, an optionally substituted alkylene group with 1 to 20 carbon atoms, an optionally substituted heteroalkylene group with 1 to 20 carbon atoms, an optionally substituted alkenylene group with 2 to 20 carbon atoms, an optionally substituted heteroalkenylene group with 2 to 20 carbon atoms, an optionally substituted arylene group with 6 to 30 carbon atoms, and an optionally substituted arylalkylene group with 7 to 30 carbon atoms; and n represents an integer of 5 to 1,000.

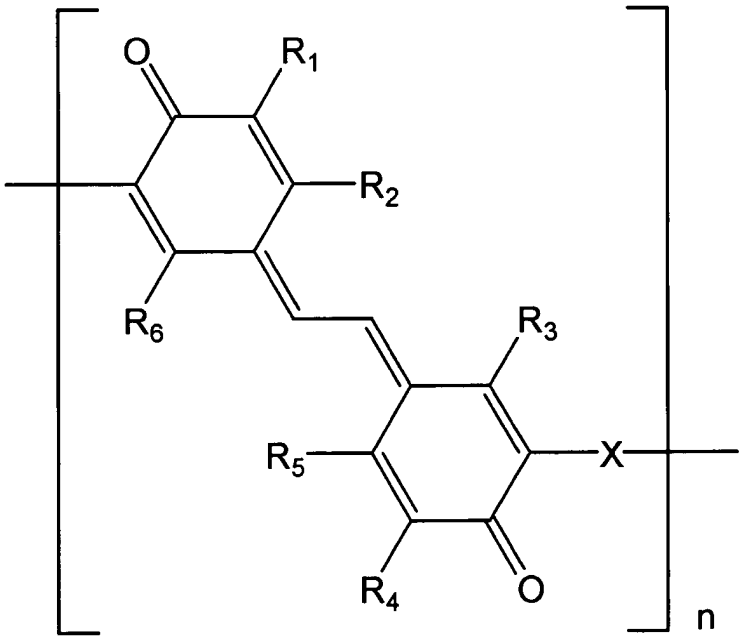
2. The polymer of claim 1, wherein an average molecular weight of the polymer is 500 to 100,000.

3. An electrophotographic photoreceptor comprising an electroconductive substrate and a photosensitive layer formed thereon, the photosensitive layer comprising the polymer of claim 1.

4. An electrophotographic photoreceptor comprising an electroconductive substrate, an intermediate layer formed thereon, and a photosensitive layer formed on the intermediate layer, the photosensitive layer containing the polymer of claim 1.

5. A process for preparing a polymer of chemical formula 1 below, which comprises refluxing methylenebisphenol in an organic solvent and in the presence of an oxidizing agent for 5 to 48 hours:

Chemical Formula 1



wherein R_1, R_2, R_3, R_4, R_5, and R_6 each independently is selected from the group consisting of a hydrogen atom, a halogen atom, a hydroxy group, a carboxyl group, a cyano group, an amino group, a nitro group, an optionally substituted alkyl group with 1 to 20 carbon atoms, an optionally substituted aryl group with 6 to 30 carbon atoms, an optionally substituted arylalkyl group with 7 to 30 carbon atoms, and an optionally substituted alkoxy group with 1 to 20 carbon atoms; -X- represents a single bond, -S-, -O-, -NH-, an optionally substituted alkylene group with 1 to 20 carbon atoms, an optionally substituted heteroalkylene group with 1 to 20 carbon atoms, an optionally substituted alkenylene group with 2 to 20 carbon atoms, an optionally substituted heteroalkenylene group with 2 to 20 carbon atoms, an optionally substituted arylene group with 6 to 30 carbon atoms, and an optionally substituted arylalkylene group with 7 to 30 carbon atoms; and n represents an integer of 5 to 1,000.

6. The process of claim 5, wherein the oxidizing agent is one of manganese dioxide, chromic acid and permanganic acid.

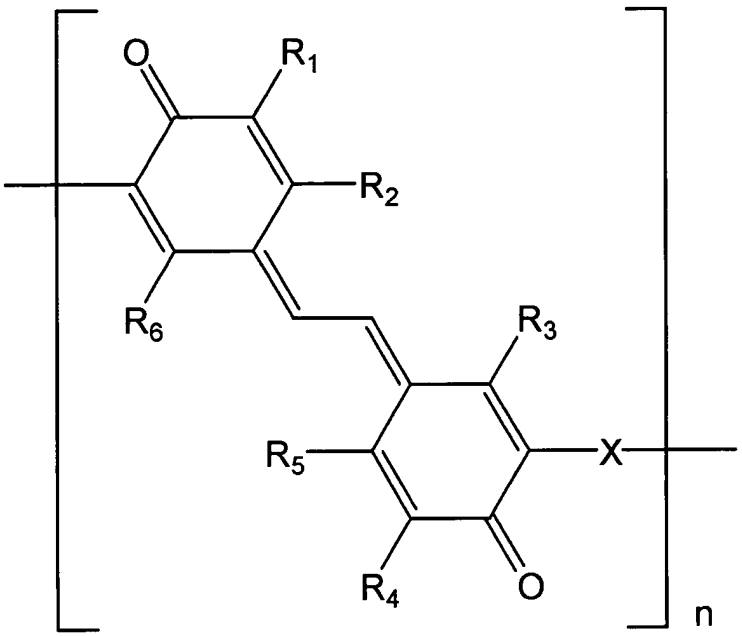
7. The process of claim 5, wherein the organic solvent is a halogenated solvent.

8. An electrophotographic cartridge, comprising:

an electrophotographic photoreceptor comprising

a photosensitive layer having at least a charge generating material, a charge transport material and a binder on a conductive support, wherein the charge transport material comprises a polymer represented by the following chemical formula 1:

Chemical Formula 1



wherein R_1, R_2, R_3, R_4, R_5, and R_6 each independently is selected from the group consisting of a hydrogen atom, a halogen atom, a hydroxy group, a carboxyl group, a cyano group, an amino group, a nitro group, an optionally substituted alkyl group with 1 to 20 carbon atoms, an optionally substituted aryl group with 6 to 30 carbon atoms, an optionally substituted arylalkyl group with 7 to 30 carbon atoms, and an optionally substituted alkoxy group with 1 to 20 carbon atoms; -X- represents a single bond, -S-, -O-, -NH-, an optionally substituted alkylene group with 1 to 20 carbon atoms, an optionally substituted heteroalkylene group with 1 to 20 carbon atoms, an optionally substituted alkenylene group with 2 to 20 carbon atoms, an optionally substituted heteroalkenylene group with 2 to 20 carbon atoms, an optionally substituted arylene group with 6 to 30 carbon atoms, and an optionally substituted arylalkylene group with 7 to 30 carbon atoms; and n represents an integer of 5 to 1,000; and

at least one of:

a charging device that charges the electrophotographic photoreceptor;

a developing device which develops an electrostatic latent image formed on the electrophotographic photoreceptor; and

a cleaning device which cleans a surface of the electrophotographic photoreceptor,

wherein the electrophotographic cartridge is attachable to/detachable from an image forming apparatus.

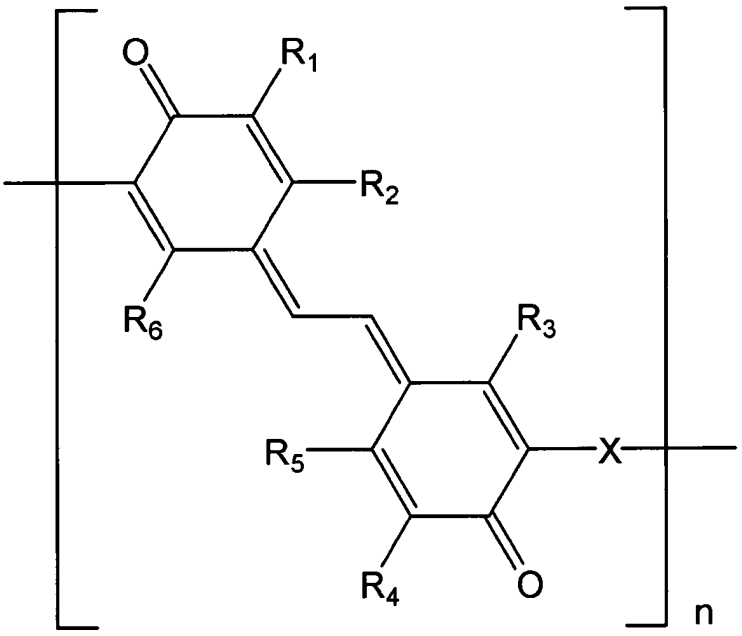
9. An electrophotographic drum, comprising:

a drum that is attachable to and detachable from an electrophotographic apparatus; and

an electrophotographic photoreceptor,disposed on the drum, the single layered electrophotographic photoreceptor comprising:

a photosensitive layer having at least a charge generating material, a charge transport material and a binder on a conductive support, wherein the charge transport material comprises a polymer represented by the following chemical formula 1:

Chemical Formula 1



wherein R_1, R_2, R_3, R_4, R_5, and R_6 each independently is selected from the group consisting of a hydrogen atom, a halogen atom, a hydroxy group, a carboxyl group, a cyano group, an amino group, a nitro group, an optionally substituted alkyl group with 1 to 20 carbon atoms, an optionally substituted aryl group with 6 to 30 carbon atoms, an optionally substituted arylalkyl group with 7 to 30 carbon atoms, and an optionally substituted alkoxy group with 1 to 20 carbon atoms; -X- represents a single bond, -S-, -O-, -NH-, an optionally substituted alkylene group with 1 to 20 carbon atoms, an optionally substituted heteroalkylene group with 1 to 20 carbon atoms, an optionally substituted alkenylene group with 2 to 20 carbon atoms, an optionally substituted heteroalkenylene group with 2 to 20 carbon atoms, an optionally substituted arylene group with 6 to 30 carbon atoms, and an optionally substituted arylalkylene group with 7 to 30 carbon atoms; and n represents an integer of 5 to 1,000.

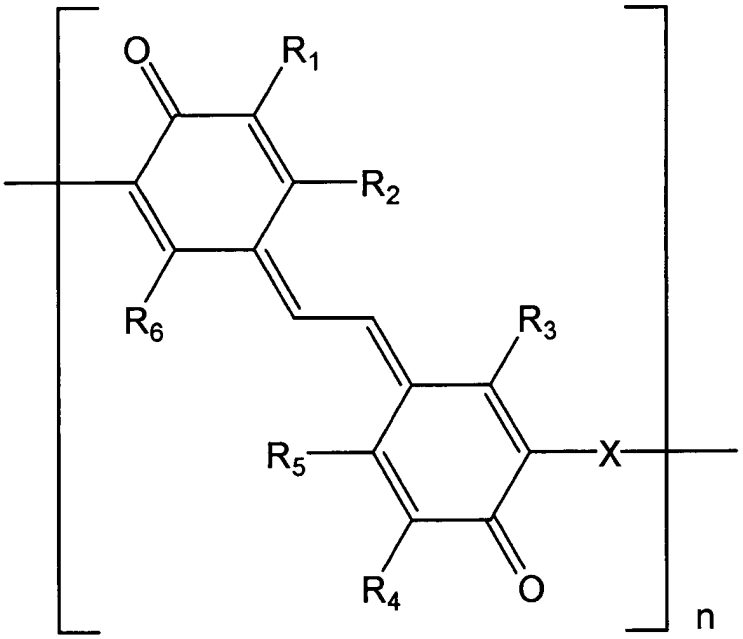
10. An image forming apparatus comprising:

a photoreceptor unit comprising:

an electrophotographic photoreceptor comprising:

a photosensitive layer having at least a charge generating material, a charge transport material and a binder on a conductive support, wherein the charge transport material comprises a polymer represented by the following chemical formula 1:

Chemical Formula 1



wherein R_1, R_2, R_3, R_4, R_5, and R_6 each independently is selected from the group consisting of a hydrogen atom, a halogen atom, a hydroxy group, a carboxyl group, a cyano group, an amino group, a nitro group, an optionally substituted alkyl group with 1 to 20 carbon atoms, an optionally substituted aryl group with 6 to 30 carbon atoms, an optionally substituted arylalkyl group with 7 to 30 carbon atoms, and an optionally substituted alkoxy group with 1 to 20 carbon atoms; -X- represents a single bond, -S-, -O-, -NH-, an optionally substituted alkylene group with 1 to 20 carbon atoms, an optionally substituted heteroalkylene group with 1 to 20 carbon atoms, an optionally substituted alkenylene group with 2 to 20 carbon atoms, an optionally substituted heteroalkenylene group with 2 to 20 carbon atoms, an optionally substituted arylene group with 6 to 30 carbon atoms, and an optionally substituted arylalkylene group with 7 to 30 carbon atoms; and n represents an integer of 5 to 1,000;

a charging device which charges the photoreceptor unit;

an imagewise light irradiating device which irradiates the charged photoreceptor unit with imagewise light to form an electrostatic latent image on the photoreceptor unit;

a developing unit that develops the electrostatic latent image with a toner to form a toner image on the photoreceptor unit; and

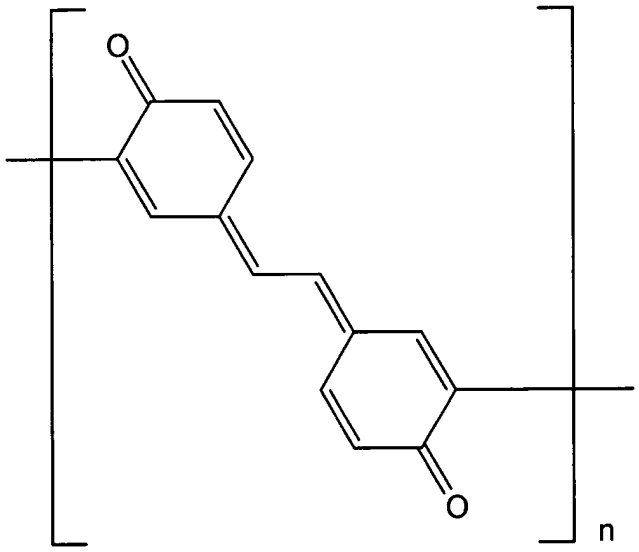
a transfer device which transfers the toner image onto a receiving material.

11. The process of claim 7, wherein the halogenated solvent is one of: chloroform, dichloromethane, and dichloroethane.

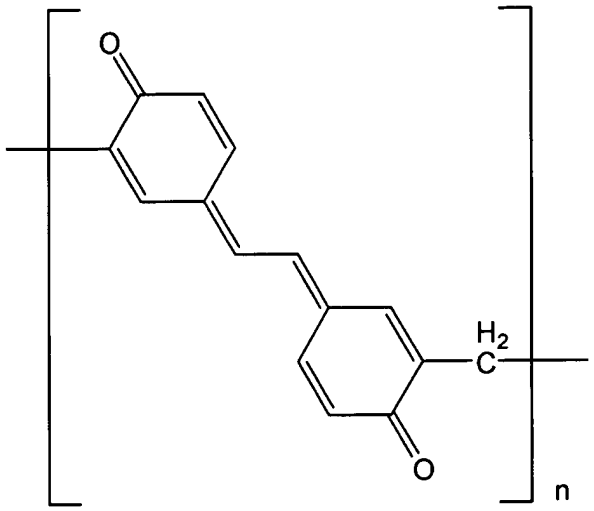
12. The polymer of claim 5, wherein the average molecular weight of the polymer of Chemical Formula 1 is 100 to 100,000.

13. The polymer of claim 1, wherein the polymer of Chemical Formula 1 is one of:

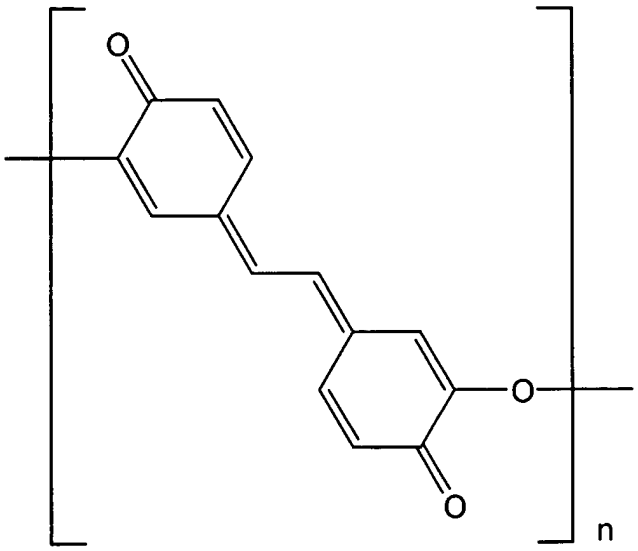
Chemical Formula 2



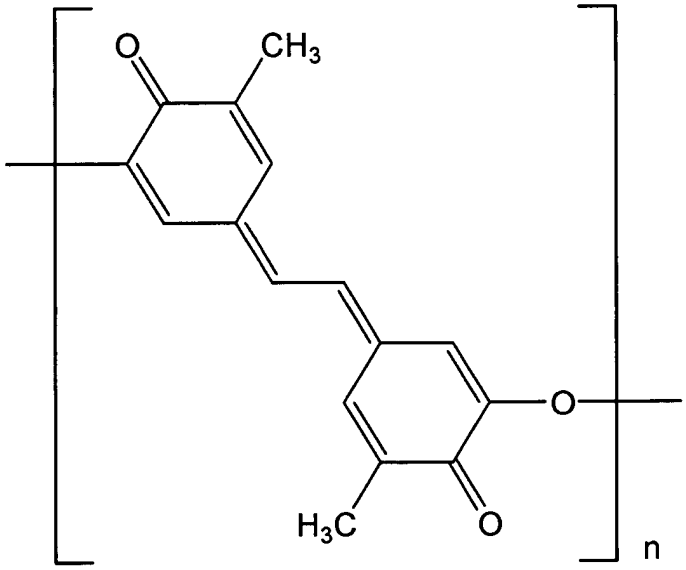
Chemical Formula 3



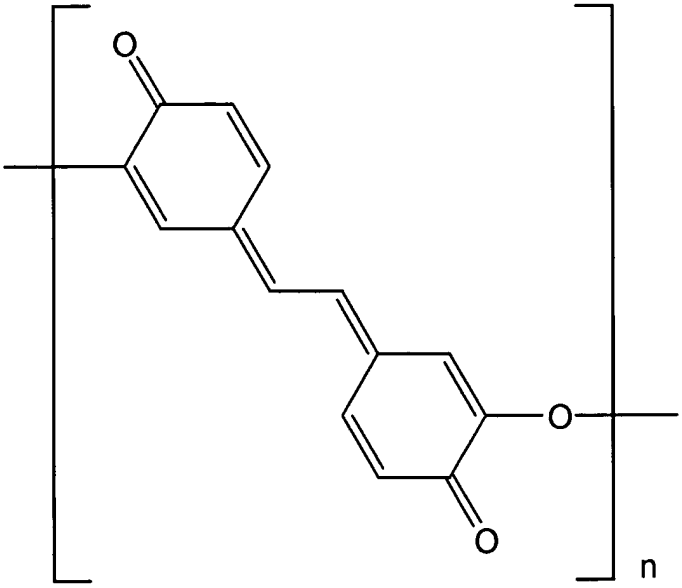
Chemical Formula 4



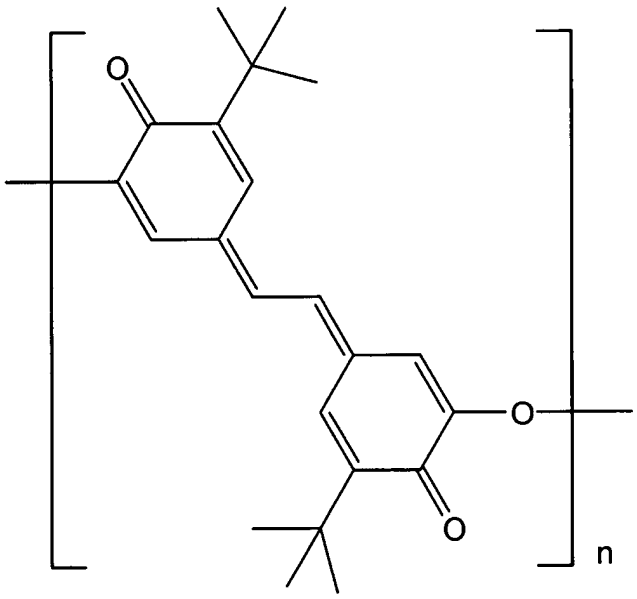
Chemical Formula 5



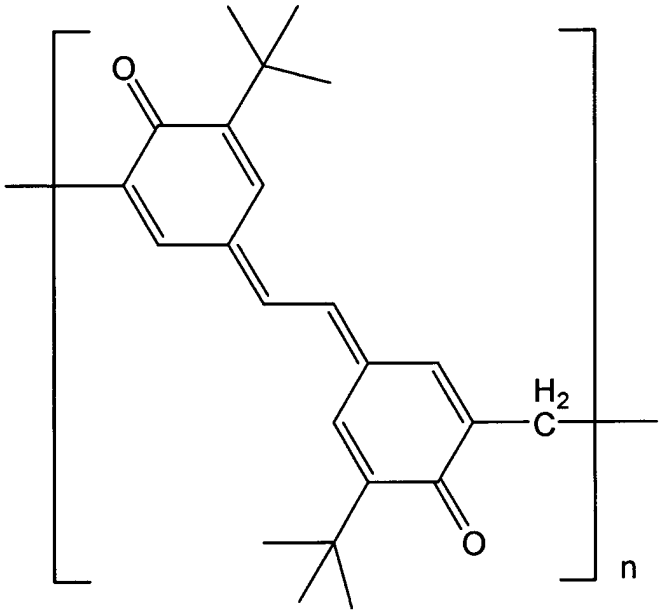
Chemical Formula 6



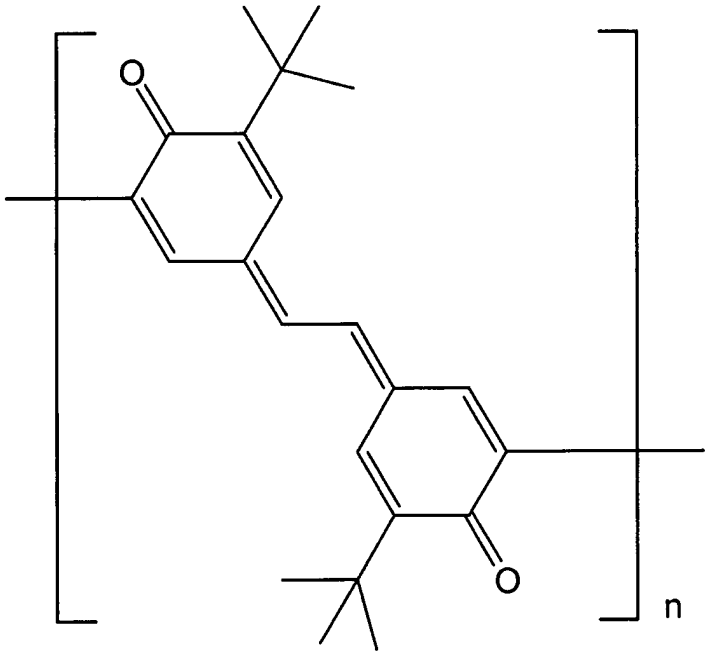
Chemical Formula 7



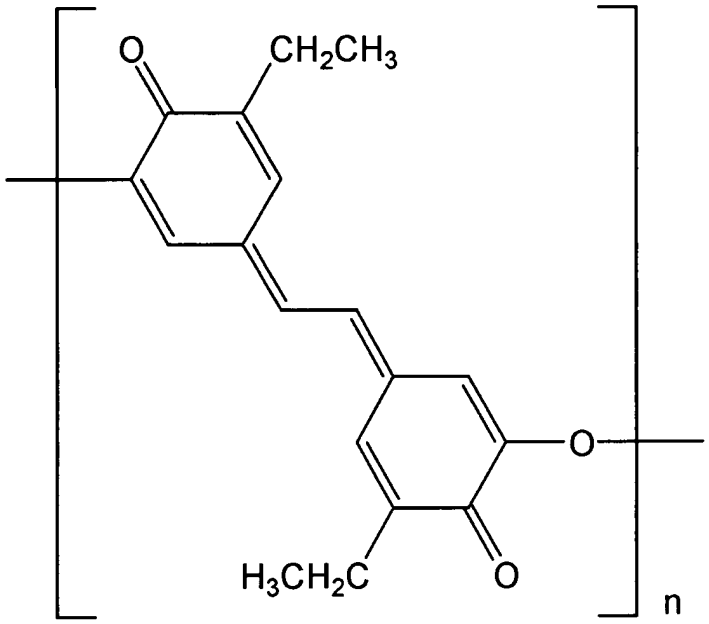
Chemical Formula 8



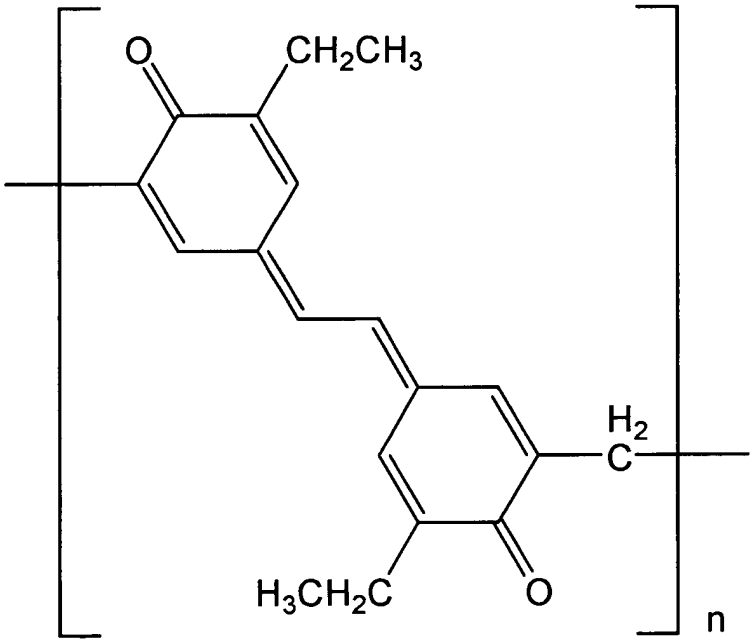
Chemical Formula 9



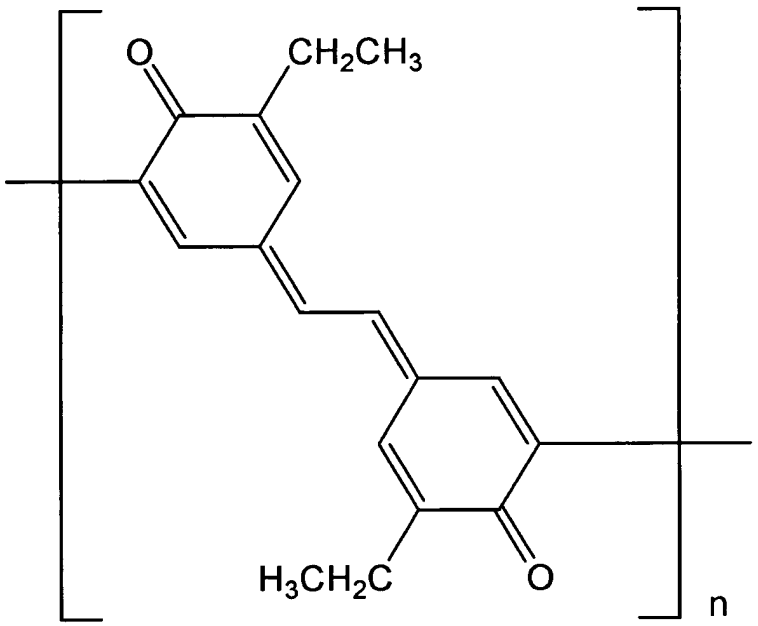
Chemical Formula 10



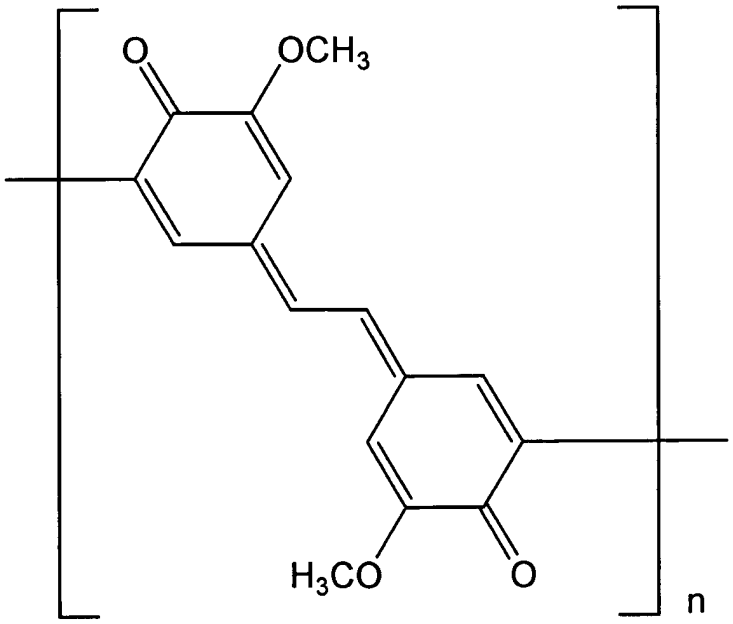
Chemical Formula 11



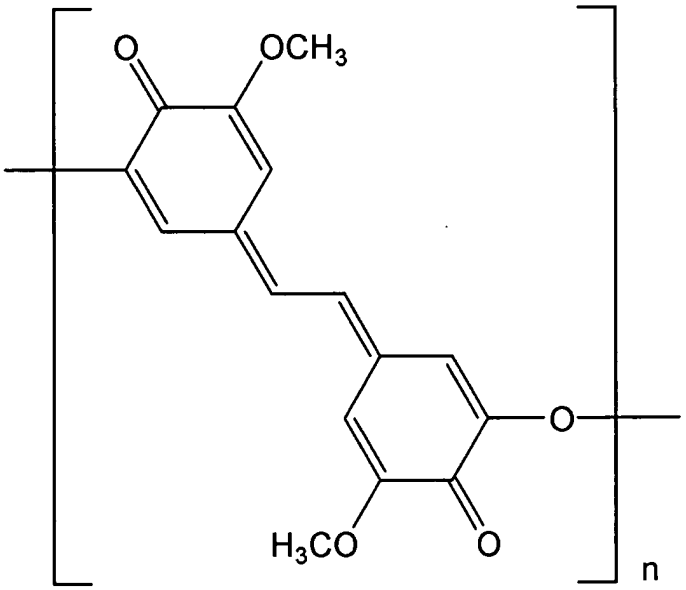
Chemical Formula 12



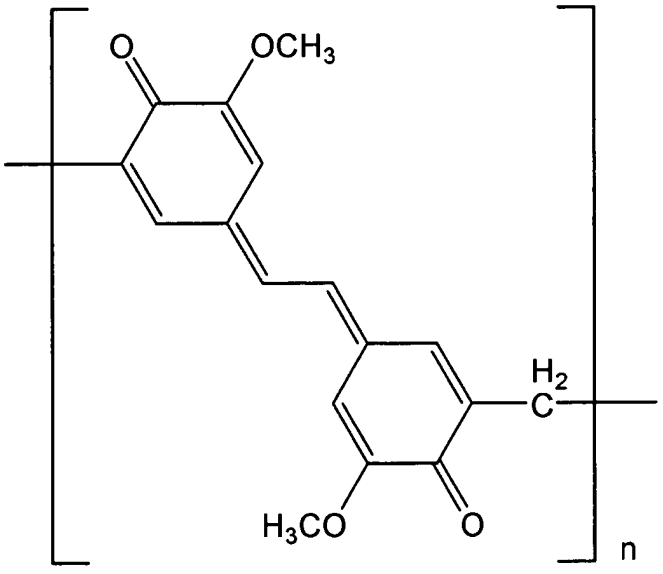
Chemical Formula 13



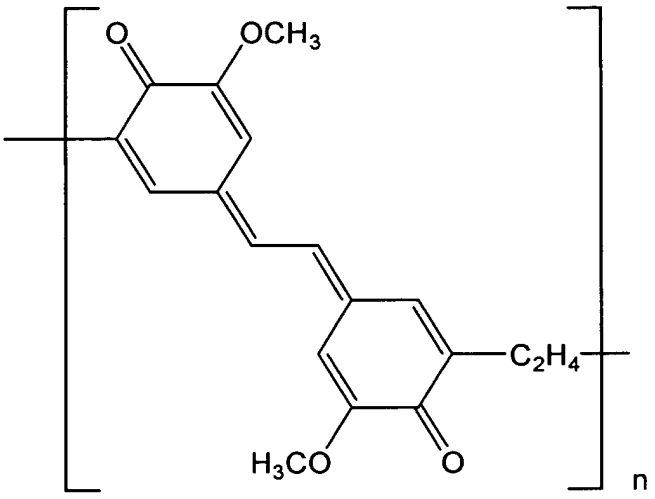
Chemical Formula 14



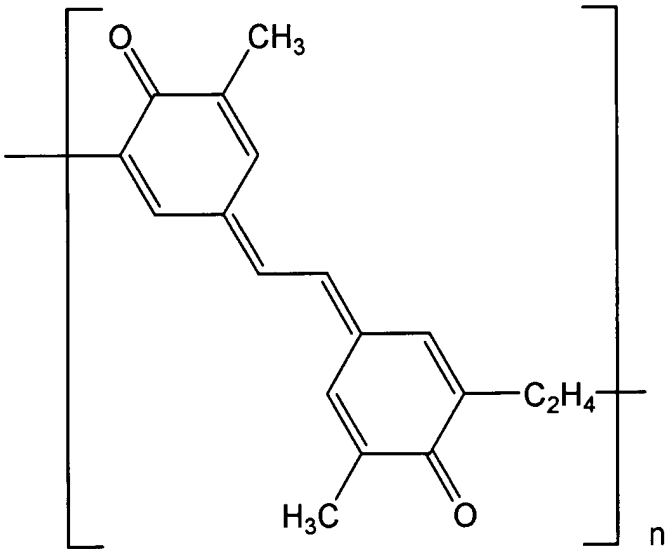
Chemical Formula 15



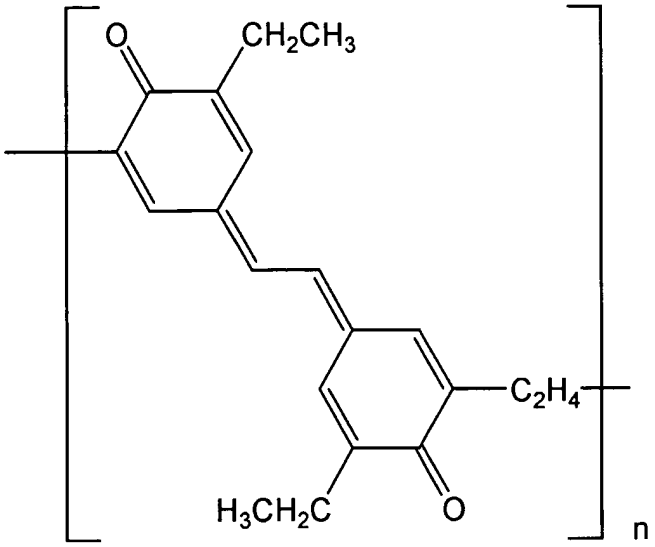
Chemical Formula 16



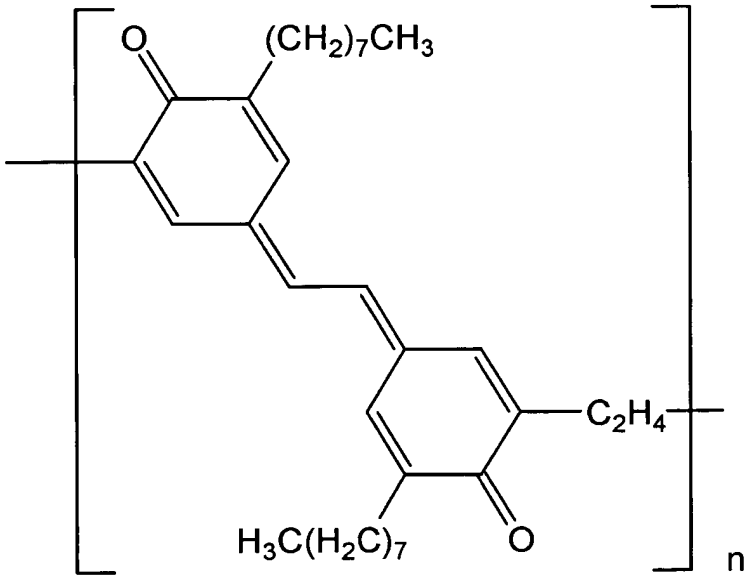
Chemical Formula 17



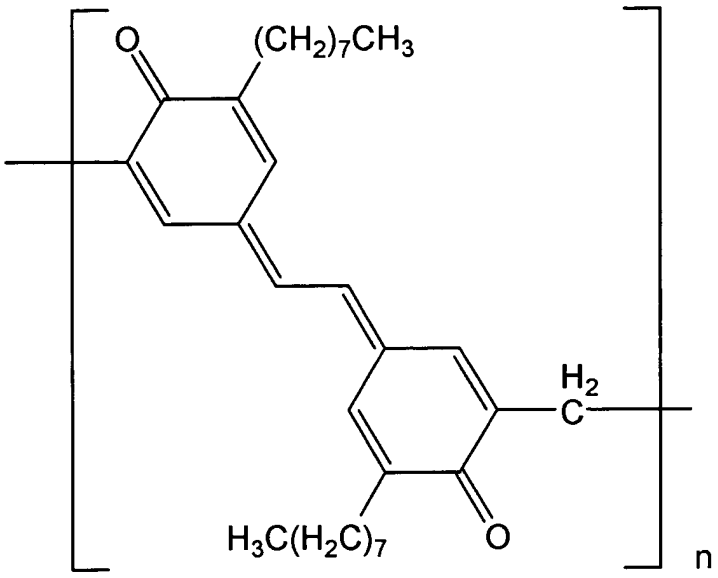
Chemical Formula 18



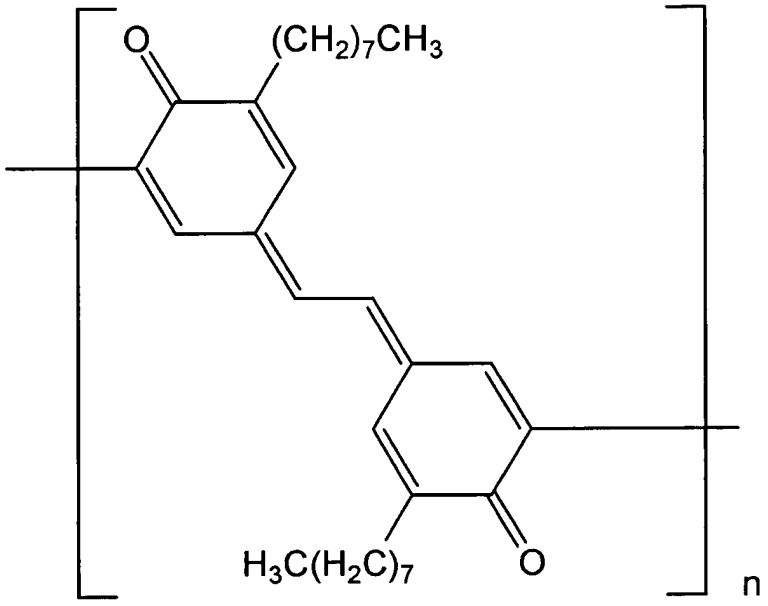
Chemical Formula 19



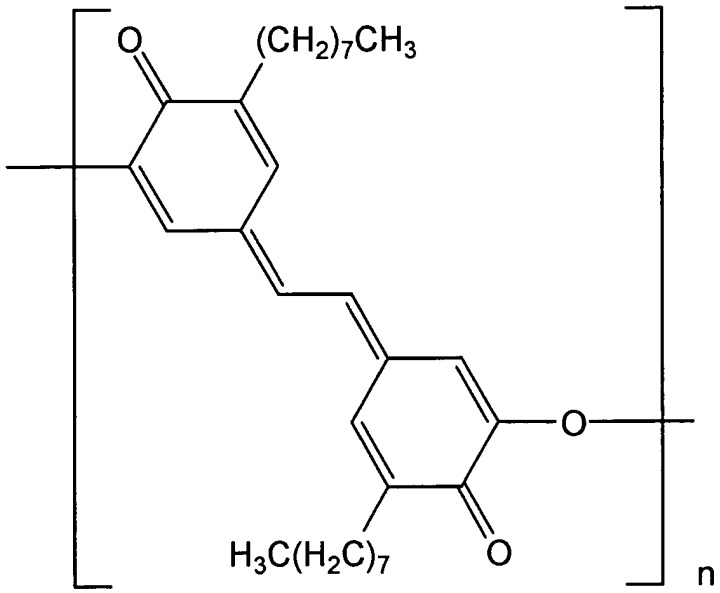
Chemical Formula 20



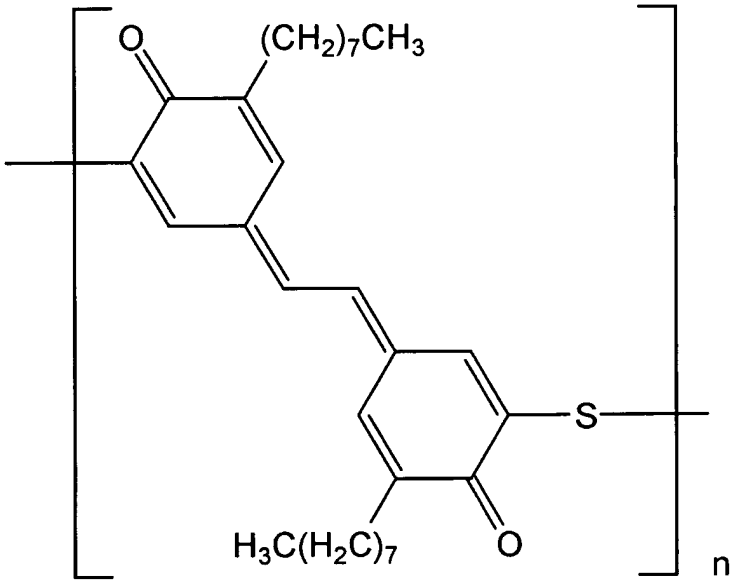
Chemical Formula 21



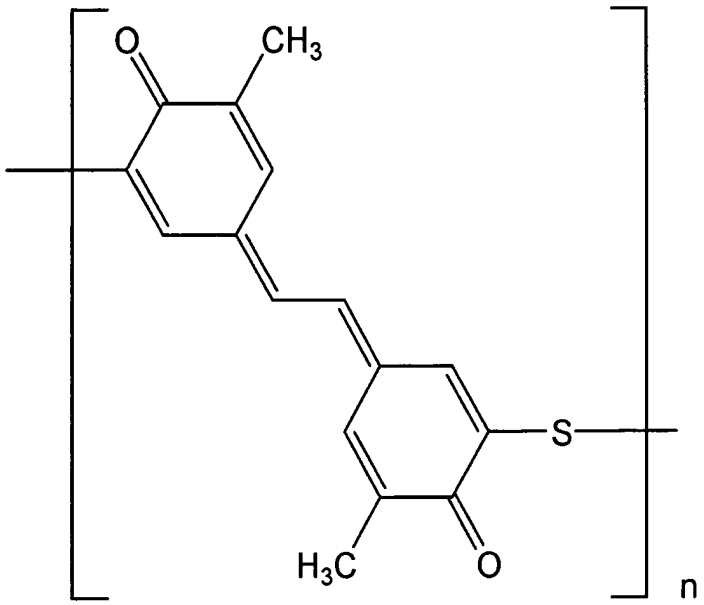
Chemical Formula 22



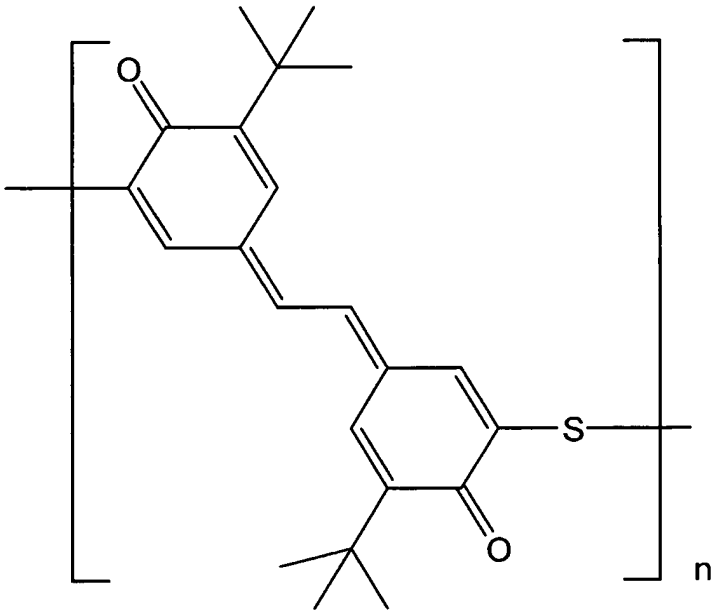
Chemical Formula 23



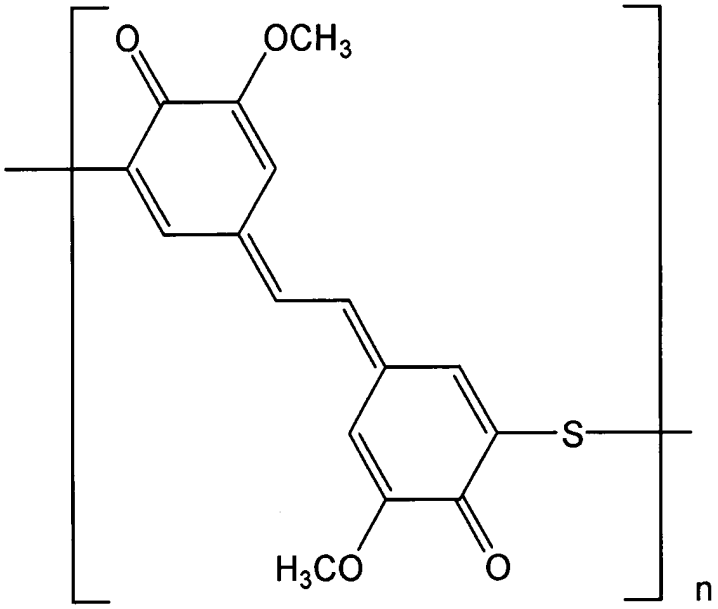
Chemical Formula 24



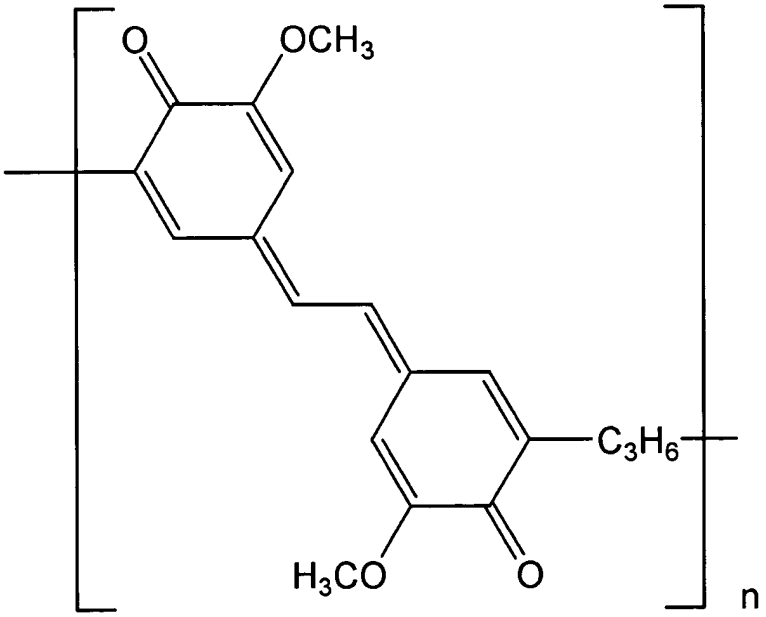
Chemical Formula 25



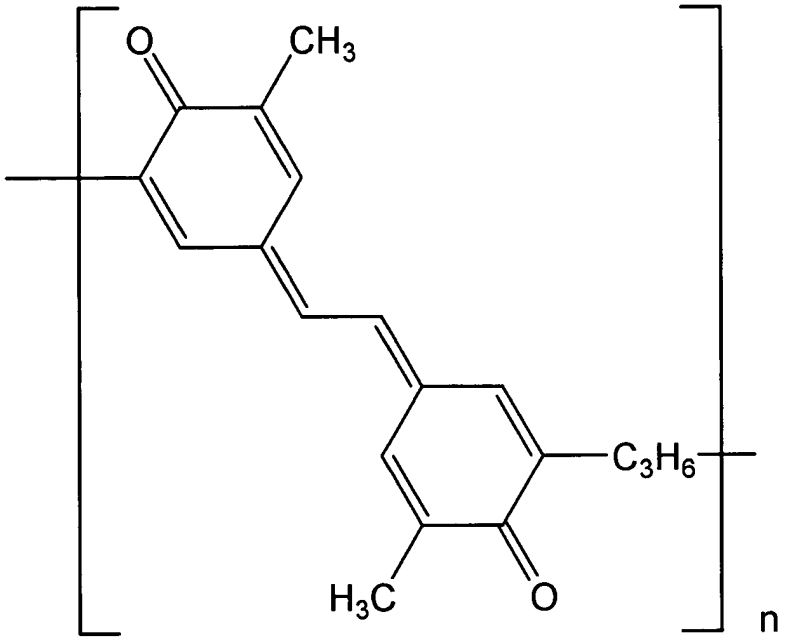
Chemical Formula 26



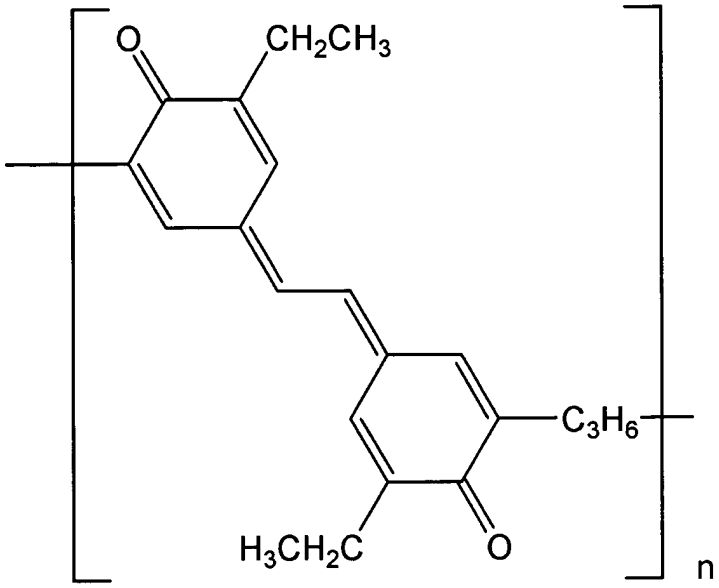
Chemical Formula 27



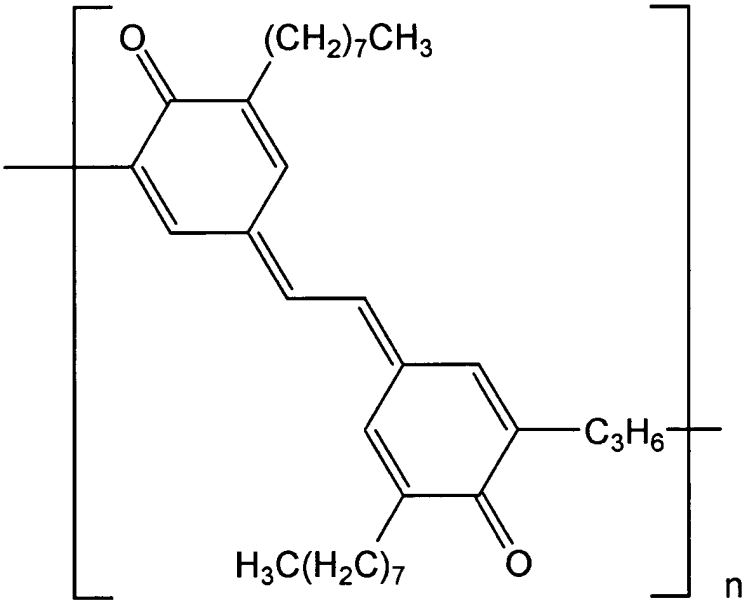
Chemical Formula 28



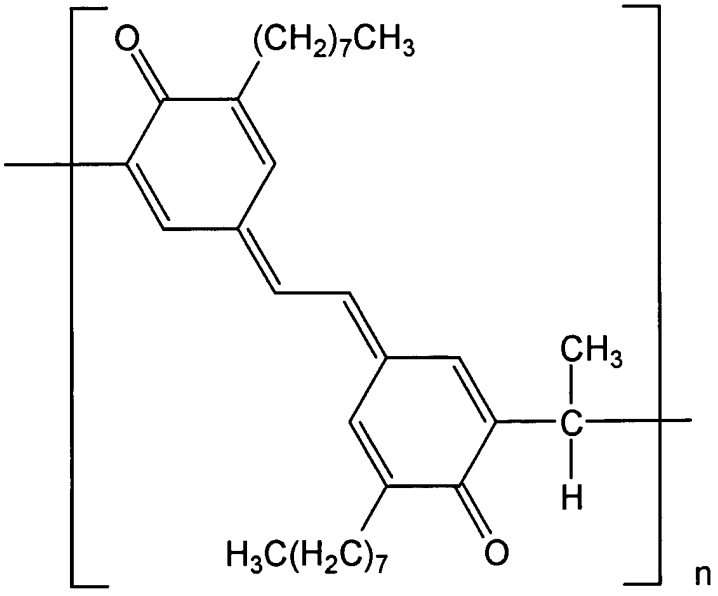
Chemical Formula 29



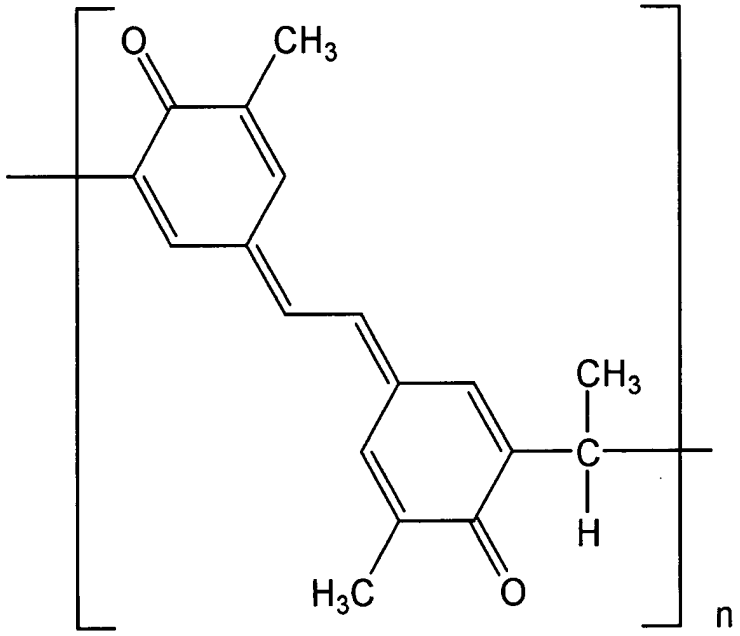
Chemical Formula 30



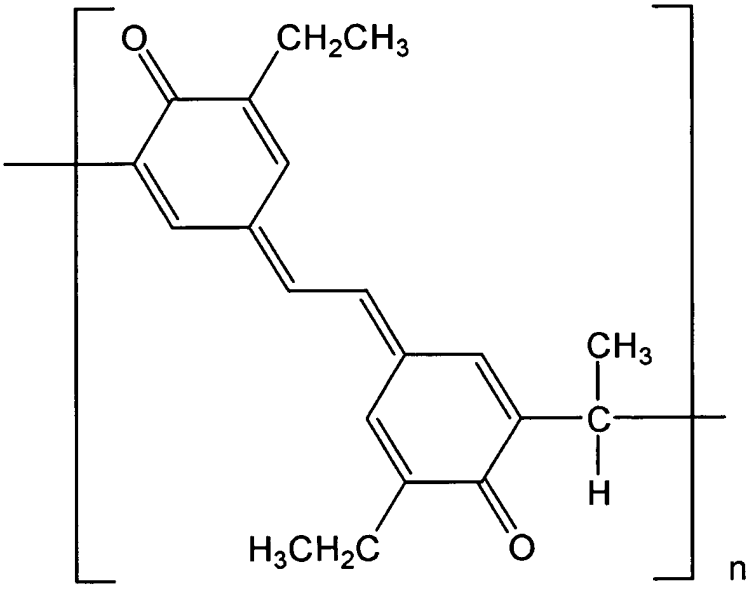
Chemical Formula 31



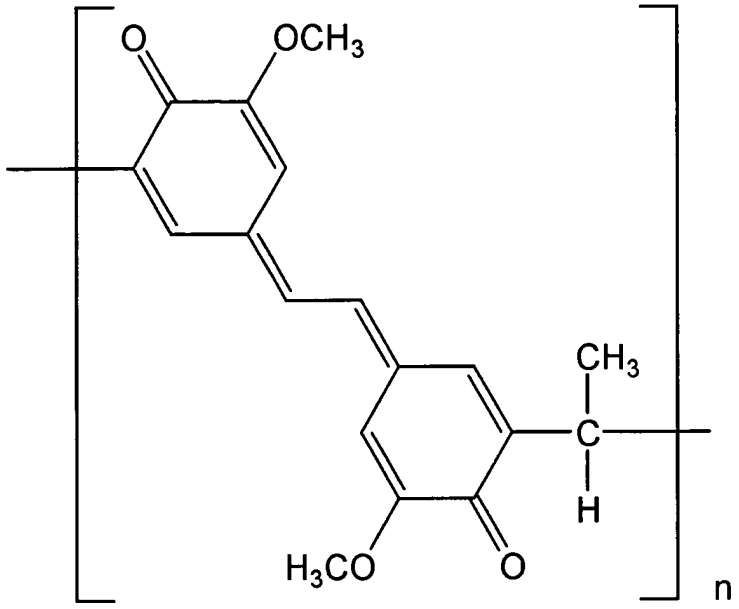
Chemical Formula 32



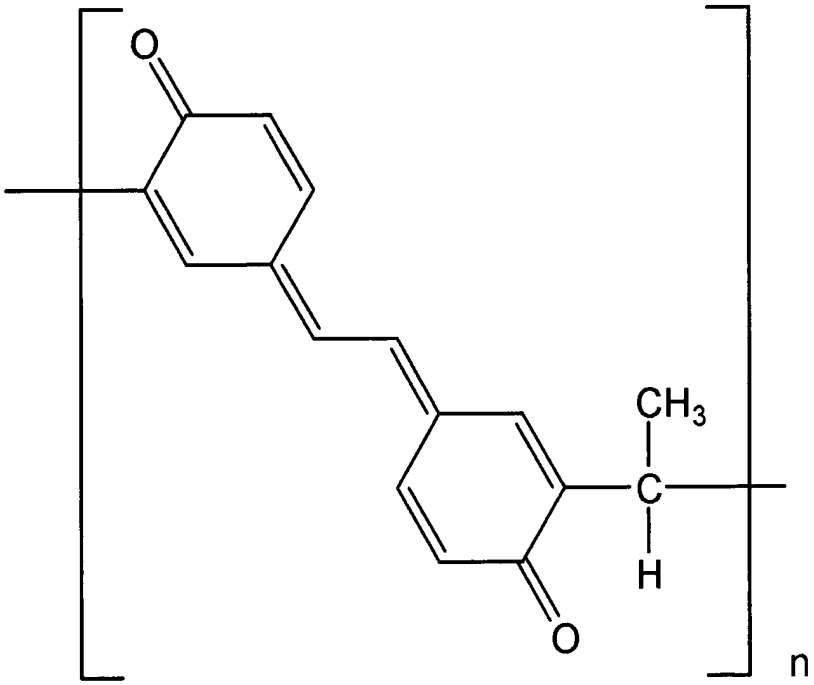
Chemical Formula 33



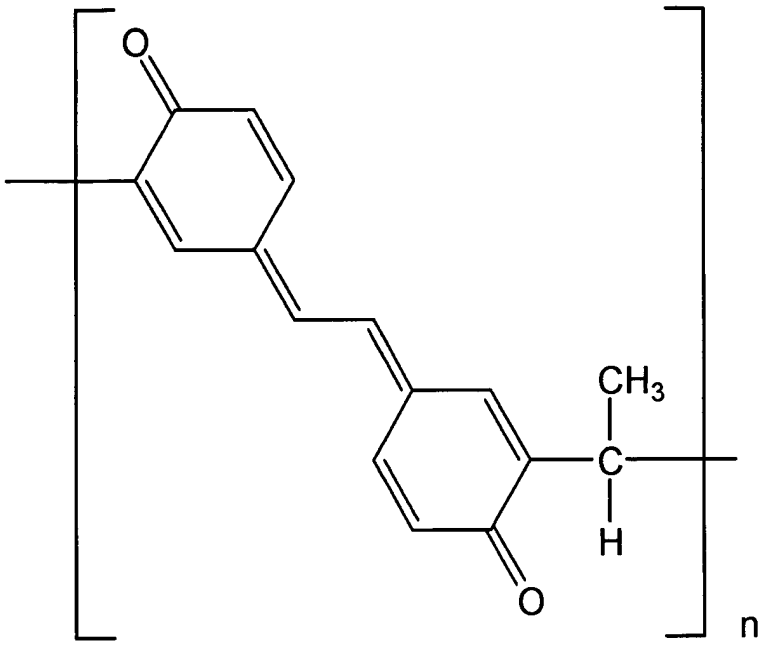
Chemical Formula 34



Chemical Formula 35



Chemical Formula 36



14. The electrophotographic photoreceptor of claim 4 wherein the intermediate layer is a conductive layer.

15. The electrophotographic photoreceptor of claim 14, wherein the conductive layer is one of: cargon black, graphite, a metal powder and a metal oxide.

16. The electrophotographic photoreceptor of claim 4, wherein the intermediate layer is a barrier layer.

17. The electrophotographic photoreceptor of claim 16, wherein the barrier layer is one of: an anodized surface layer of aluminum, a layer of a resin, and a layer of a mixture containing the resin and at least one metallic oxide powder.

18. The electrophotographic photoreceptor of claim 17, wherein the metallic oxide powder is one of: titanium oxide powder and tin oxide powder.

19. The electrophotographic photoreceptor of claim 18, wherein the resin is one of: polyvinyl alcohol, casein, ethyl cellulose, gelatin, phenol resin and a polyamide.

20. The electrophotographic photoreceptor of claim 4, wherein the polymer of Chemical Formula 1 functions as a charge/electron transporting material and is located in one of:

a charge transporting layer of a laminated type photosensitive layer that includes a further layer comprising a charge generating material; and

a single layer, combined with the charge generating material, of a single layered type photosensitive layer.

21. The electrophotographic photoreceptor of claim 20, wherein the charge generating material comprises at least one of, alone or in combination: a pthalocyanine pigment, an azo pigment, a quinone pigment, a perylene pigment, an indigo pigment, a bisbenzoimidazole pigment, a quinacridone pigment, an azulenium dye, a squarilium dye, a pyrylium dye, a triarylmethane dye, a cyanine dye, amorphous silicon, amorphous selenium, trigonal selenium, tellurium, a selenium-tellurium alloy, cadmium sulphide, antimone sulfide, and zinc sulfide.

22. The electrophotographic photoreceptor of claim 21, wherein, in a laminated type photosensitive layer, the charge generating material is dissolved in a solvent with a binder resin to form a film on an electroconductive substrate by one of: coating, vacuum deposition, sputtering and chemical vapor deposition (CVD) to form a charge generating layer.

23. The electrophotographic photoreceptor of claim 22, wherein the binder resin is an electrically insulating polymer.

24. The electrophotographic photoreceptor of claim 23, wherein the binder resin is at least one of, alone or in combination: polycarbonate, polyester, methacrylic resin, acryl resin, polyvinylchloride, polyvinylidene chloride, polystyrene, polyvinylacetate, silicon resin, silicon-alkyd resin, styrene-alkyd resin, poly-N-vinylcarbazole, phenoxy resin, epoxy resin, polyvinyl butyral, polyvinyl acetal, polyvinyl formal, polysulfone, polyvinyl alcohol, ethylcellulose, phenol resin, polyamide, carboxymethyl cellulose and polyurethane.

25. The electrophotographic photoreceptor of claim 20, wherein the polymer of Chemical Formula 1 functions as a charge/electron transporting material and is located in a charge transporting layer of a laminated type photosensitive layer that includes a further layer comprising a charge generating material, wherein, In forming the laminated type photosensitive layer, one of:

the charge transporting layer having the polymer of Chemical Formula 1 is formed on the charge generating layer; and

the charge generating layer is formed on the charge transporting layer having the polymer of Chemical Formula 1.

26. The electrophotographic photoreceptor of claim 20, wherein the polymer of Chemical Formula 1 functions as a charge/electron transporting material and is located in a single layer, combined with the charge generating material, of a single layered type photosensitive layer, the single layered type photosensitive layer is made from a solution containing a charge generating material, a charge transporting material, a binder resin and a solvent.

27. The electrophotographic photoreceptor of claim 20, wherein the polymer of Chemical Formula 1 functions as a charge/electron transporting material and is combined with at least one other charge transporting material that is one of: a hole transporting material and an electron transporting material for a single layered type photoreceptor.

28. The electrophotographic photoreceptor of claim 27, wherein the hole transporting material is at least one of: a nitrogen containing cyclic compound and a condensed polycyclic compound selected from the group consisting of pyrenes, hydrazones, oxazoles, oxadiazoles, pyrazolines, arylamines, arylmethanes, benzidines, tiazoles, styryls, polymer compounds having the foregoing substituents in a main chain or a side chain, and polysilanes having the foregoing substituents in a main chain or a side chain.

29. The electrophotographic photoreceptor of claim 27, wherein the electron transporting material comprises at least one of, alone or in combination: a benzoquinone, a cyanoethylene, a cyanoquinodimethanes, a fluorenone, a xanthone, a phenanthraquinone, a phthalic acid anhydride, a thiopyran and a diphenoquinone.

30. The electrophotographic photoreceptor of claim 27, wherein the electron transporting material is an electron transporting polymer or pigment with n-type semiconductor characteristics.

31. The electrophotographic photoreceptor of claim 20, wherein a thickness of the photosensitive layer is approximately 5 μm to 50 μm for both the single layered type and the laminated type photosensitive layers.

32. The electrophotographic photoreceptor of claim 22, wherein a ratio of the charge transporting material and the binding resin is approximately 1:0.5 to 1:2.

33. The electrophotographic photoreceptor of claim 22, wherein at least one of: a plasticizer, a leveling agent, a dipersing stabilizer, an antioxidant and a photostabilizer is added with the binder resin.

34. The electrophotographic photoreceptor of claim 33, wherein the antioxidant is derived from one of: phenols, sulfurs, phosphors and amines.

35. The electrophotographic photoreceptor of claim 33, wherein the photostabilizer comprises at least one of, alone or in combination: a benzotriazole compound, a benzophenone compound and a hindered amine compound.

36. The electrophotographic photoreceptor of claim 3, wherein the electrophotographic photoreceptor is utilized in one of: a copy machine, a laser printer, a CRT printer, an LED printer, a liquid crystal printer, and a laser electronic photographer.

37. The polymer of claim 1, wherein the alkyl group, as a substituent for the polymer of Chemical Formula 1, is a linear or a branched radical with 1 to 12 carbon atoms.

38. The polymer of claim 37, wherein the alkyl group, as a substituent for the polymer of Chemical Formula 1, is a linear or a branched radical with 1 to 8 carbon atoms.

39. The polymer of claim 1, wherein the alkoxy group, as a substituent for the polymer of Chemical Formula 1, is a linear or a branched, oxygen-containing radical with alkyl moiety having 1 to 20 carbon atoms.

40. The polymer of claim 39, wherein the alkoxy group is a lower alkoxy radical with 1 to 6 carbon atoms.

41. The polymer of claim 40, wherein the alkoxy group is a lower haloalkoxy radical with 1 to 3 carbon atoms.

42. The polymer of claim 1, wherein the aryl group, as a substituent for the polymer of Chemical Formula 1, is a cyclic aromatic hydrocarbon with 6 to 30 carbon atoms in at least one ring structure, and may be used solely or in a combination, wherein a plurality of rings is held together by one of: a pendant method and fusing together, and the term "aryl" includes aromatic radicals.

43. The polymer of claim 1, wherein the aryl group, as a substituent for the polymer of Chemical Formula 1, is a cyclic aromatic hydrocarbon with 6 to 30 carbon atoms in at least one ring structure, and may be used solely or in a combination, wherein a plurality of rings is held together by one of: a pendant method and fusing together, and the term "aryl" includes phenyl having 1 to 5 substituents selected from the group consisting of hydroxy, halo, haloalkyl, nitro, cyano, alkoxy and lower alkylamino.

44. The polymer of claim 1, wherein the aralkyl group, as a substituent for the polymer of Chemical Formula 1, is an aryl group with one or more hydrogens substituted with a lower alkyl radical.

45. The polymer of claim 1, wherein the alkylene group, as a substituent for the polymer of Chemical Formula 1, is a linear or a branched divalent aliphatic hydrocarbon with 1 to 20 carbon atoms.

46. The polymer of claim 1, wherein the alkylene group, as a substituent for the polymer of Chemical Formula 1, is a linear or a branched divalent aliphatic hydrocarbon with 1 to 6 carbon atoms.

47. The polymer of claim 1, wherein the heteroalkylene group, as a substituent for the polymer of Chemical Formula 1, is an alkylene group with one or more heteroatoms.

48. The polymer of claim 1, wherein the alkenylene group, as a substituent for the polymer of Chemical Formula 1, is a linear or branched divalent alkenyl group containing 2 to 20 carbon atoms, which has at least one double bond within the chain.

49. The polymer of claim 1, wherein the alkenylene group, as a substituent for the polymer of Chemical Formula 1, is a linear or branched divalent alkenyl group containing 2 to 10 carbon atoms, wherein, where desired, one or more hydrogen atom in the alkenylene group is substituted with a hydroxy, or a halogen atom.

50. The polymer of claim 1, wherein the heteroalkenylene group, as a substituent for the polymer of Chemical Formula 1, is an alkenylene group with one or more heteroatoms.

51. The polymer of claim 1, wherein the arylene group, as a substituent for the polymer of Chemical Formula 1, is a divalent aryl with 6 to 30 carbon atoms.

52. The polymer of claim 1, wherein the arylene group, as a substituent for the polymer of Chemical Formula 1, is a divalent aryl with 6 to 20 carbon atoms, wherein, where desired, one or more hydrogen atoms in the arylene group is substituted with a hydroxy, a halogen atom, or a lower alkyl group

53. The polymer of claim 1, wherein the aralkylene group, as a substituent for the polymer of Chemical Formula 1, has 7 to 30 carbon atoms.

54. The polymer of claim 1, wherein the aralkylene group, as a substituent for the polymer of Chemical Formula 1, has 7 to 20 carbon atoms.